

SECTION 620 PAVEMENT MARKING APPLICATION

620.01 DESCRIPTION. This work is the application of temporary, interim and final pavement markings, including lines, words, and symbols. Temporary and interim striping is specified in Section 618.03.10.

620.02 MATERIALS. Furnish materials meeting the following requirements:

Temporary Pavement Marking Tape	Subsection 714.01
Temporary Pavement Marking Tabs	Subsection 714.02
Preformed Plastic Pavement Marking Material	Subsection 714.03
Traffic Line Paint	Subsection 714.04
Reflective Glass Beads	Subsection 714.05
Reflective Thermoplastic Pavement Markings	Subsection 714.06

620.03 CONSTRUCTION REQUIREMENTS.

620.03.1 Layout of Pavement Markings. The Project Manager will furnish the necessary survey notes for the Contractor to establish the horizontal line control for pavement markings.

Establish and maintain pavement marking control lines within 0.25 feet (75 mm) of the true line.

Apply centerline and shoulder lines within 0.30 feet (90 mm) of the true line. Assure the stripe does not deviate more than 0.15 foot (50 mm) in 500 feet (152 m).

The Project Manager will check accuracy as required.

Remove and replace out of specification pavement markings at Contractor expense.

Place other pavement marking as specified in the Contract.

620.03.2 Temporary Pavement Marking Material Application.

A. Pavement Marking Tape and Tabs. Follow the marking manufacturers recommendations for road surface preparation and installation. Assure the surface is clean, dry, and free from excess oil.

B. Preformed Plastic Pavement Marking Materials. Prepare the application surface and apply the marking material following the manufacturer's recommendations.

Apply pavement markings up to 8-inches (205 mm) wide in a single application to the specified width. Apply pavement markings over 8-inches (205 mm) wide in 6-inch or 8-inch (155 or 205 mm) multiple applications and minimum fractional 4-inch (100 mm) applications.

Furnish the marking material thickness specified in the Contract.

Cut and true the marking material edges.

Place inlaid plastic pavement marking materials into the new asphalt pavement just before final compaction and roll it flush with the roadway surface during final compaction.

620.03.3 Painted Pavement Markings.

- A. Equipment Requirements.** Apply paint and glass beads with equipment manufactured specifically for stripping. Locate the bead applicator directly behind and synchronized with the paint applicator. Shield both applicator's to prevent paint spray or bead loss outside the specified line width.

Apply the stripes within 1/4-inch (6 mm) of the specified width.

The equipment must:

1. Have an automatic skip control to paint a broken-line pattern within 6-inches (155 mm) of each cycle.
2. Be able to paint up to three stripes simultaneously for final stripping (two stripes for temporary).
3. Apply paint at the following rates per gallon (Liter):
 - a. 4-inch (100 mm) solid stripe - 250-275 feet per gallon (20-22 m per L);
 - b. 4-inch (100 mm) dashed stripe (9-ft stripe/15-ft gap) (2.7 m stripe/ 4.6 m gap)- 665-735 feet per gallon (53-59 m per L);
 - c. 4-inch (100 mm) dashed stripe (10-ft stripe/30-ft gap) (3 m stripe/ 9.2 m gap)- 1000-1100 feet per gallon (80-88 m per L).

Stripes narrower and wider than 4-inches (100 mm) and words and symbols are approximately 88 square feet per gallon (2.2 m² per L)

Apply glass beads at 6 plus or minus 0.1 pounds per gallon (.72 plus or minus 0.045 kg per liter).

Equip the pavement marking machine with a flow meter/totalizer that measures paint quantities in gallons (Liters), to the nearest 0.1 gallon (0.1 L). Locate the flow meter/totalizer in the flow line to the spray nozzles at a point where the meter can be easily read from the ground. Assure the calibration adjustment is accessible without meter removal or using a calibration adjustment device.

Introduce glass beads to the paint downstream of the meter.

Calibrate the meter before use on the project and as directed.

Paint may be measured using calibrated paint tanks and measuring devices. Provide the Project Manager calibration certificates from an independent agent for the paint tank and measuring device. Re-certify the tank and measuring device annually. Provide a calibrated container to check against the tank measuring device. The tank will be checked before each use and whenever determined necessary.

Stop bars, crosswalks, and the like may be applied with hand-operated equipment.

Stop stripping work when equipment fails to apply the markings within the specified rates and tolerances until corrected.

- B. Surface Preparation and Weather Limitations.** Clean the surfaces to be painted following the paint manufacturer's recommendations.

Apply final markings during daylight hours following the paint manufacturer recommendations. Temporary and interim markings may be applied in the evening if approved. Do not apply markings when the minimum air or pavement temperatures are at or below 40 °F (4 °C), the pavement surface is wet, and the weather is foggy, rainy, or inclement. Do not apply markings when the wind prevents obtaining the specified results.

- C. Painting Curbs.** Clean the surfaces following the paint manufacturer's recommendations. Paint the tops and traffic sides of curbs at restricted parking locations as specified.
- Apply one uniform coat of yellow traffic line paint to the tops and traffic sides of all island curbs, median curbs, and other similar curbs.
- Allow concrete curbs to cure for 30 days before painting.
- For estimating purposes, 100 linear feet (30.5 m) of curbing equals approximately 115 square feet (10.7 m²) of curb surface to be painted.
- D. Striping Open-Graded Friction Course and Seal-Coated Surfaces.** Spray two full applications of centerline and shoulder-line striping.
- Apply the second application 30 days or later after the first application on the centerline of two-lane two-way roadways and all transverse lines in the opposite direction of the first application. Apply all other markings in the same direction as the first application.
- E. Marking Protection.** Protect markings until dry. Correct smeared or damaged markings at Contractor expense.
- F. Interim Pavement Marking Quantities.** The paint quantities in the Contract include both interim and final pavement marking applications. The Project Manager will determine if an interim application is needed.
- Use paint for the interim application when the final marking specified is a plastic pavement marking.

620.03.4 Temporary Pavement Markings. Place temporary pavement markings meeting Subsection 618.03.10 requirements.

620.03.5 Thermoplastic Pavement Marking Application.

- A. General.** The applicable requirements of Subsection 620.03.2 (B) apply to placing thermoplastic marking material.
- B. Material Acceptance.** Furnish the Project Manager copies of the manufacturer's product specification data before delivering thermoplastic marking material to the project.
- Do not place materials not meeting the manufacturer's product specifications.
- The Project Manager may request a manufacturer's sample or take field samples at the point of application for testing.
- The Department will test samples for one or any combination of the specified requirements.
- Remove and replace material represented by failing samples at Contractor expense.
- C. Manufacturer's Instructions.** Submit the manufacturer's instructions for surface preparation and material application before applying thermoplastic.
- Include the following:
- Equipment Requirements
 - Work Methods and Procedures
 - Material Application Temperature Range
 - Ambient and Surface Temperature Requirements
 - Weather limitations
 - Precautions

All other requirements necessary for successful application and satisfactory performance.

Materials supplied without application instructions or with incomplete instructions will not be permitted in the work.

D. Surface and Temperature Requirements. Meet the following requirements unless otherwise recommended by the manufacturer:

1. The minimum allowable ambient air and pavement surface temperature for application is 60 °F (16 °C).
2. The pavement surface, including grooved pavement for inlay applications, must be dry during application.

The inspector will perform a visual sight and touch inspection that must not indicate dampness. If any question exists concerning the pavement dryness, the following test may be performed. Tape a piece of aluminum foil, roofing paper, or clear plastic wrap to the pavement surface. Wait approximately 15 minutes. Do not apply markings if moisture appears beneath the material.

E. Temperature Monitoring and Heating Equipment. Equip melting and application equipment for thermoplastic material with permanently attached easily read thermometers that provide a true, continuous, representative temperature of the material.

Use an oil bath heating kettle that provides indirect heat to the material to pre-melt the thermoplastic material.

The pre-melting kettles must have rotating agitators that stir the thermoplastic material during heating.

F. Surface Preparation. Follow the manufacturers surface preparation instructions.

G. Primer/Sealer. Follow the pavement marker manufacturer's recommendations for applying primer/sealer. If no recommendations are made, apply a thin, uniform coat of MC-800 on the pavement surfaces and grooved areas to receive the pavement markings.

H. Application. Apply hot thermoplastic marking material to the specified thickness by one or more of the following methods following the manufacturer's instructions.

1. Spraying;
2. Extruding (Top-applied);
3. Extruding into cut or ground grooves (Inlaid).

Apply the extruded thermoplastic to the thickness specified in Table 620-1. Thirty mils (1 mm) of the total applied thickness must project above the finished pavement surface.

**TABLE 620-1
THICKNESS OF INLAID THERMOPLASTIC MARKINGS**

400 Mils (10 mm)	275 Mils (7 mm)
Words and Symbols	Median Borders
Crosswalks	Continuous Centerline
Stop Bars	Dashed Centerline
8" White Lane Lines	Dashed Lane Lines
Dotted or Skip Lines	Shoulder Lines

Produce thermoplastic markings having straight and uniform edges that adhere to the pavement.

Finish the extruded lines, including words and symbols at least 1/4-inch (6 mm) wider than the groove widths at each edge and within the ranges shown in Table 620-2.

**TABLE 620-2
ALLOWABLE MARKING WIDTH/GROOVE WIDTH
TOLERANCE RANGES**

SPECIFIED WIDTH	GROOVE WIDTH	FINISHED *MARKING WIDTH
4" (100 mm)	3½" - 4" (90-100 mm)	4" - 4½" (100-115 mm)
8" (205 mm)	7½" - 8" (190-205 mm)	8" - 8½" (205-215 mm)
24" (610 mm)	23½" - 24" (600-610 mm)	24" - 25½" (610-650 mm)

* The finished marking width cannot exceed 1/4-inch (6 mm) wider than the finished width.

Match the FHWA manual "Standard Alphabets For Highway Signs and Pavement Markings" for words and symbols. Produce the markings within 1/4-inch (6 mm) per 4-inches (100 mm) of width.

Use templates for extruding words and symbols that are larger than the grooves and meet the tolerance ranges in Table 620-2 to provide the required edge sealing.

Clean the grooves before placing the thermoplastic material. Meet the surface requirements in Subsection 620.03.5 (D).

Apply thermoplastic material in grooves within 24 hours of grooving.

Keep traffic off the grooves and re-clean them as necessary before applying the thermoplastic material.

- I. **Glass Bead Application.** Apply glass beads by drop-on methods immediately after the thermoplastic material application meeting Subsection 620.03.3 (A) requirements.

The minimum glass bead application rate is 6 pounds per 100 square feet (0.30 kg per square meter) of thermoplastic material. The Project Manager may increase the glass bead application rate.

- J. **Marking Protection.** Protect the thermoplastic pavement markings from traffic until it has dried as specified in Article 4.3.2 of AASHTO M 249.

- K. **Markings - Dimensional Tolerances.** Finish the markings to the specified minimum uniform cross sectional hardened thickness.

Trim lines, words, and symbols to produce sharp, neat lines on all sides and ends.

Meet a linear tolerance of plus or minus 6-inches (155 mm) over each cycle on specified broken-line patterns.

Meet Table 620-2 tolerances for finished line widths.

- L. **Joints.** Meet the following for joints in the finished extruded thermoplastic markings:

1. Extrude transverse markings full width with a maximum of one transverse joint per length of line.
2. Apply words and symbols without joints within each symbol, letter, or numeral. Letters made with one or more straight legs (A, L, N, T, etc.) and combination arrows (through and right or through and left, etc.) may be applied with one pass per leg. Combination arrows may be applied with one pass for each arrowhead of the marking.
3. Extrude 4 and 8-inch (100 and 205 mm) longitudinal lines full width in one pass with no transverse joints. Transverse joints are acceptable only for lines exceeding 100 feet (30.5 m) in length and lines shorter than 100 feet (30.5 m) that require a change of direction in the application equipments path.
4. Extrude lines 24-inches (610 mm) wide full width in one pass with a maximum of one transverse joint per length of line.

Finish joints to form neat lines without gaps or unevenness and that are moisture proof.

- M. **Patching and Repairing.** Use material from the same batch of thermoplastic material used in the original work.

The patching or repair may be performed mechanically or manually. Re-apply beads as specified. Meet all specified dimensional tolerances and match the original lines.

- N. **Cleaning and Trimming of Markings.** Remove irregularities in finished markings without chipping, cracking, or otherwise damaging the markings or causing delaminations or separations between the pavement and thermoplastic material. Follow the manufacture's recommendations for cleaning and trimming of the markings. Do not damage the pavement or thermoplastic material.

620.03.6 Pavement Marking Removal. Remove existing temporary and final pavement markings as specified.

The removal methods are as follows:

1. Sand blasting with air or water;
2. High-pressure water;
3. Steam or super-heated water;
4. Mechanically grinding, sanding, scraping, brushing, burning.

Submit the method or methods to be used before use. The Contractor may submit written proposals for other removal methods. An approved method may be subsequently disapproved if it damages the pavement surface or inadequately removes existing markings.

Remove sand or other material on the pavement left by the removal as the work progresses.

Cover remaining discoloration with a thin asphalt fog coat.

Satisfactorily repair roadway surfaces damaged by marking removal at Contractor expense.

620.04 METHOD OF MEASUREMENT.

620.04.1 Preformed Plastic and Thermoplastic Pavement Markings. Preformed plastic and thermoplastic pavement striping is measured by the linear foot (meter).

Words and symbols are measured by the square foot (square meter).

620.04.2 Painted Pavement Markings and Curbs. Painted pavement striping, words and symbols, stop bars, crosswalks, hashmarks, and other striping not placed by a striping truck are measured by the gallon (Liter). Painting curbs is measured by the gallon (Liter).

Quantity measurements are based on flow meter/totalizer readings taken before and after each run or if a calibrated tank is used, tank measurements are taken before and after each run.

The amount of paint measured is the difference in the readings. All readings that measure paint for payment will be taken by the Project Manager. Provide all necessary assistance to make the readings including sufficient notice before the paint work begins.

620.04.3 Temporary Pavement Markings. Temporary pavement markings are measured under Subsection 618.04.2

620.04.4 Removal of Pavement Markings. Pavement striping removal is measured by the linear foot (meter) based on a 4-inch (100 mm) width. Lines wider and narrower than 4-inches (100 mm) are converted to the equivalent linear feet (meter) of 4-inch (100 mm) wide line.

Removal of words and symbols is measured by the square foot (square meter) and converted to the equivalent linear feet (meter) of 4-inch (100 mm) wide line.

620.05 BASIS OF PAYMENT. Payment for the completed and accepted quantities is made under the following:

<u>Pay Item</u>	<u>Pay Unit</u>
Preformed Plastic/ Thermoplastic Pavement Striping	Linear Foot (meter)
Preformed Plastic/Thermo-plastic Markings Thermo-plastic Markings	Square Foot (Square Meter)
Truck-applied Painted Pavement Markings ..	Gallon (liter)
Words, symbols, Stop Bars, Hash Marks	Gallon (liter)
Painted Curb Markings	Gallon (liter)
Temporary Pavement Markings	Mile (kilometer)
Remove Pavement Markings	Linear Foot (Linear Meter) or Square Foot (Square Meter)

Repaint all highway striping represented by test samples showing volatiles exceeding 42 percent or when any paint property is outside 15 percent of any specified value at Contractor expense.

The contract unit price will be reduced by ten percent for traffic striping with any paint property outside 5 percent of any specified value.

Payment at the contract unit prices is full compensation for all resources necessary to complete the item of work under the Contract.